AMENDMENT

IN THE SPECIFICATION:

Please delete the paragraphs beginning at Page 6, line 21 and continuing through Page 16, line 5, and replaced these deleted paragraphs with the following text:

–The present invention is implemented to solve the foregoing problems. It is therefore an object of the present invention to achieve highly accurate channel estimation by obtaining highly accurate channel estimates by assigning appropriate weighting factors to individual data symbols in the same slot, and by calculating a sum of appropriately weighted pilot symbols in respective slots before and after the slot the data symbols belong to, when carrying out the channel estimation of the data symbols.

The highly accurate channel estimation and compensation for channel fluctuations in the data symbols based on the channel estimation make it possible for the absolute coherent detection to decide the absolute phase of each data symbol even in the Rayleigh fading environment, which can reduce the SNIR for achieving desired receiving quality (receiving error rate). This can reduce the transmission power, and increase the capacity of a system in terms of the number of simultaneous subscribers.

In order to accomplish the object aforementioned, in the first aspect of the present invention, there is provided a channel estimation unit for obtaining channel estimates of data symbols from pilot symbols in a combined symbol sequence which has a plurality of slots and includes the data symbols and the pilot symbols, comprising:

means for locating the pilot symbols in the combined symbol sequence;

means for generating pilot blocks by extracting the pilot symbols from two or more slots in the combined symbol sequence in accordance with a located result; and

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means for obtaining the channel estimates of the data symbols by calculating a weighted sum of averages of the pilot symbols in the individual pilot blocks,

wherein a magnitude of weighting differs between at least two data symbols in each slot, and

the power of the data symbols and pilot symbols is controlled on a slot by slot basis.

In the second aspect of the present invention, there is provided a CDMA receiver which receives a combined symbol sequence that is spread, has a plurality of slots, and includes data symbols and pilot symbols, and which generates a data sequence, comprising:

means for receiving the spread combined symbol sequence;

means for generating a combined symbol sequence by despreading the spread combined symbol sequence;

means for locating the pilot symbols in the combined symbol sequence;

means for generating pilot blocks by extracting the pilot symbols from two or more slots in the combined symbol sequence in accordance with a located result;

means for obtaining channel estimates of the data symbols by calculating a weighted sum of averages of the pilot symbols in the individual pilot blocks;

means for obtaining a data symbol sequence by eliminating the pilot symbols from the combined symbol sequence in accordance with the located result;

means for compensating for channel fluctuations in the data symbol sequence by using the channel estimates of the data symbols; and

means for generating the data sequence by demodulating the data symbol sequence compensated for,

wherein a magnitude of weighting differs between at least two data symbols in each slot.

In the third aspect of the present invention, there is provided a CDMA transceiver including a transmitting processor and a receiving processor, comprising:

means for generating a data symbol sequence by modulating a data sequence;

means for generating a combined symbol sequence by inserting pilot symbols into the data symbol sequence;

means for generating a spread combined symbol sequence by spreading the combined symbol sequence; and

means for transmitting the spread combined symbol sequence,

wherein the spread combined symbol sequence to be transmitted has a plurality of slots and the receiving processor comprises:

means for receiving the spread combined symbol sequence;

means for generating the combined symbol sequence by despreading the spread combined symbol sequence;

means for locating the pilot symbols in the combined symbol sequence;

means for generating pilot blocks by extracting the pilot symbols from two or more slots in the combined symbol sequence in accordance with a located result;

means for obtaining channel estimates of the data symbols by calculating a weighted sum of averages of the pilot symbols in the individual pilot blocks;

means for obtaining a data symbol sequence by eliminating the pilot symbols from the combined symbol sequence in accordance with the located result;

means for compensating for channel fluctuations in the data symbol sequence by using the channel estimates of the data symbols; and

means for generating the data sequence by demodulating the data symbol sequence compensated for,

wherein a magnitude of weighting differs between at least two data symbols in each slot.

Here the transmitting processor may further comprise means for inserting into the data symbol sequence a power control symbol sequence for controlling power of the data symbols and pilot symbols.

Here the receiving processor may further comprise means for measuring from the pilot symbols a signal-to-noise and interference power ratio, and for generating the power control symbol sequence from the signal-to-noise and interference power ratio.

Here the receiving processor may further comprise means for extracting, from the data symbol sequence compensated for, the power control symbol sequence for controlling power of the data symbols and pilot symbols, and the means for transmitting the spread combined symbol sequence transmits the spread combined symbol sequence in accordance with the power control symbol sequence.

Here the power of the data symbols and pilot symbols may be controlled on a slot by slot basis.

Here the number of data symbols included in each slot of the combined symbol sequence may be the same, and the number of pilot symbols included in each slot of the combined symbol sequence may be the same.

Here the pilot blocks each may consist of all the pilot symbols in each slot.

Here when obtaining the channel estimates of the data symbols in an nth slot in the combined symbol sequence, where n is an integer, the pilot blocks may be generated from (n-K+1)th slot to (n+K)th slot in the combined symbol sequence, where K is a natural number.

Here the pilot blocks closer to the data symbol with which the channel estimate is to be obtained may have a greater weight.

In the fourth aspect of the present invention, there is provided a channel estimation method of obtaining channel estimates of data symbols from pilot symbols in a combined symbol sequence which has a plurality of slots and includes the data symbols and the pilot symbols, comprising the steps of:

locating the pilot symbols in the combined symbol sequence;

generating pilot blocks by extracting the pilot symbols from two or more slots in the combined symbol sequence in accordance with a located result; and

obtaining the channel estimates of the data symbols by calculating a weighted sum of averages of the pilot symbols in the individual pilot blocks

wherein a magnitude of weighting differs between at least two data symbols in each slot, and

the power of the data symbols and pilot symbols is controlled on a slot by slot basis.

In the fifth aspect of the present invention, there is provided a CDMA receiving method of generating a data sequence by receiving a combined symbol sequence that has a plurality of slots, includes data symbols and pilot symbols, and is spread, comprising the steps of:

receiving the spread combined symbol sequence;

generating the combined symbol sequence by despreading the spread combined symbol sequence;

locating the pilot symbols in the combined symbol sequence;

generating pilot blocks by extracting the pilot symbols from two or more slots in the combined symbol sequence in accordance with a located result;

obtaining channel estimates of the data symbols by calculating a weighted sum of averages of the pilot symbols in the individual pilot blocks;

obtaining a data symbol sequence by eliminating the pilot symbols from the combined symbol sequence in accordance with the located result;

compensating for channel fluctuations in the data symbol sequence by using the channel estimates of the data symbols; and

generating the data sequence by demodulating the data symbol sequence compensated for,

wherein a magnitude of weighting differs between at least two data symbols in each slot.

In the sixth aspect of the present invention, there is provided a CDMA transmitting and receiving method comprising the steps of:

on a transmitting side,

generating a data symbol sequence by modulating a data sequence;

generating a combined symbol sequence by inserting pilot symbols into the data symbol sequence;

generating a spread combined symbol sequence by spreading the combined symbol sequence; and

transmitting the spread combined symbol sequence,

wherein the spread combined symbol sequence to be transmitted has a plurality of slots, and on a receiving side,

receiving the spread combined symbol sequence;

generating the combined symbol sequence by despreading the spread combined symbol sequence;

locating the pilot symbols in the combined symbol sequence;

generating pilot blocks by extracting the pilot symbols from two ore more slots in the combined symbol sequence in accordance with a located result;

obtaining channel estimates of the data symbols by calculating a weighted sum of averages of the pilot symbols in the individual pilot blocks;

obtaining a data symbol sequence by eliminating the pilot symbols from the combined symbol sequence in accordance with the located result;

compensating for channel fluctuations in the data symbol sequence by using the channel estimates of the data symbols; and

generating the data sequences by demodulating the data symbol sequence compensated for,

wherein a magnitude of weighting differs between at least two data symbols in each slot.

In the seventh aspect of the present invention, there is provided a channel estimation unit for obtaining channel estimates of data symbols from pilot symbols in a combined symbol sequence which has a plurality of slots and includes the data symbols and the pilot symbols, said channel estimation unit comprising:

means for locating the pilot symbols in the combined symbol sequence;

means for generating pilot blocks by extracting the pilot symbols from two or more slots in the combined symbol sequence in accordance with a located result; and

means for obtaining the channel estimates of the data symbols by calculating a weighted sum of averages of the pilot symbols in the individual pilot blocks,

wherein a magnitude of weighting differs between at least two data symbols in each slot, and when obtaining the channel estimates of the data symbols in an nth slot in the combined

symbol sequence, where n is an integer, the pilot blocks are generated from (n-K+1)th slot to (n+K)th slot in the combined symbol sequence, where K is a natural number.

In the eighth aspect of the present invention, there is provided a channel estimation method of obtaining channel estimates of data symbols from pilot symbols in a combined symbol sequence which has a plurality of slots and includes the data symbols and the pilot symbols, said channel estimation method comprising the steps of:

locating the pilot symbols in the combined symbol sequence;

generating pilot blocks by extracting the pilot symbols from two or more slots in the combined symbol sequence in accordance with a located result; and

obtaining the channel estimates of the data symbols by calculating a weighted sum of averages of the pilot symbols in the individual pilot blocks,

wherein a magnitude of weighting differs between at least two data symbols in each slot, and when obtaining the channel estimates of the data symbols in an nth slot in the combined symbol sequence, where n is an integer, the pilot blocks are generated from (n-K+1)th slot to (n+k)th slot in the combined symbol sequence, where K is a natural number.--